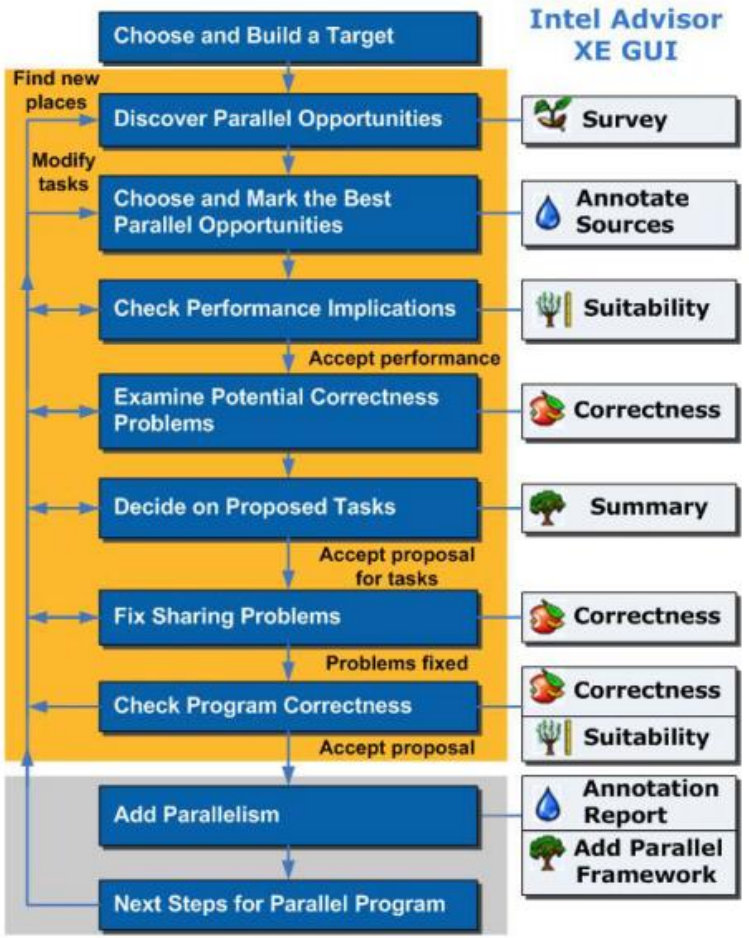
Intel® Advisor XE 2013

Intel® Advisor XE

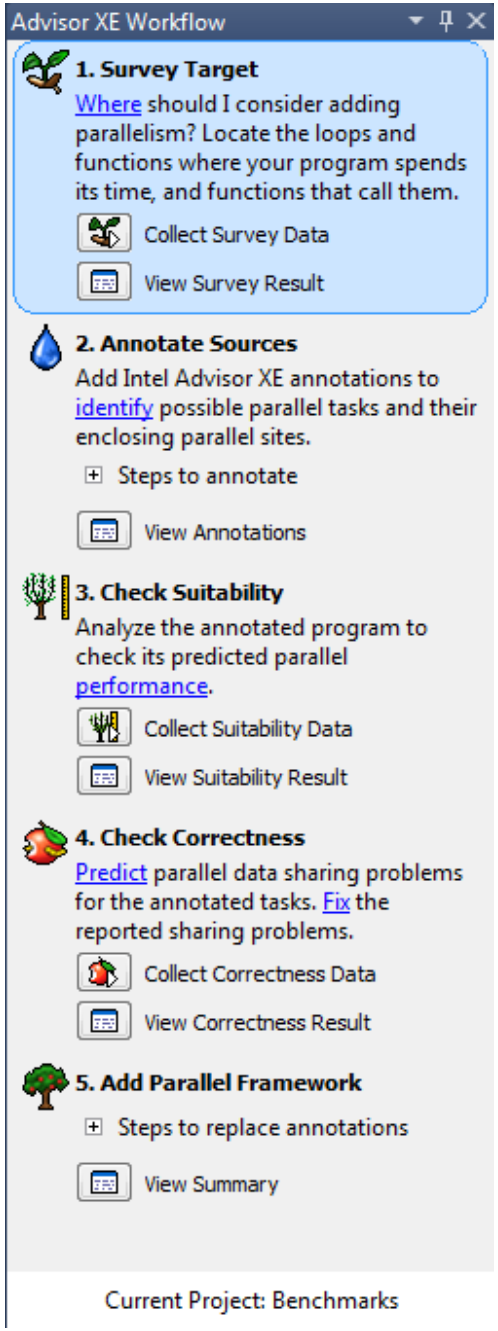
- Tool for what-if analysis
  - Modeling: use code annotations to introduce parallelism
  - Evaluation: estimate the effect e.g. the speedup
  - GUI-driven assistant (5 steps)
- Productivity and Safety
  - Parallel correctness is checked based on a correct program
  - Non-intrusive API
- It's not auto-parallelization
- It's not modifying the code



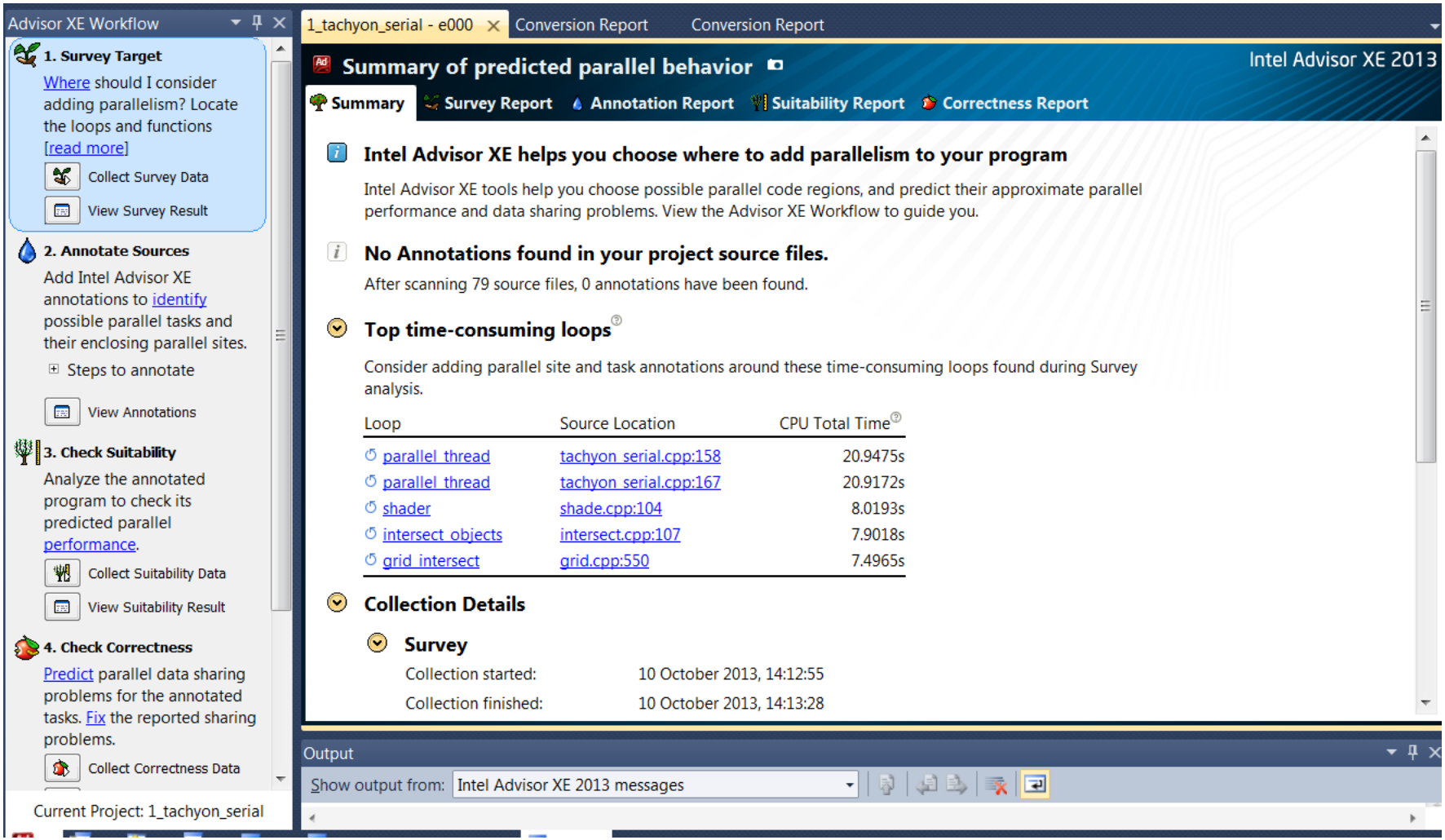
Intel® Advisor XE Stages

Transforming many serial algorithms into parallel form takes 5 easy high-level steps:

1. **Survey and Summary tools**: where to add parallelism
2. **Annotations**: experiment with parallel program structure
3. **Suitability tool**: predict and model program scalability
4. **Correctness tool**: discover potential synchronization problems
5. Manually convert annotations to **parallel framework** API (with a little help of Annotations/Summary)



Survey Target



Annotate Sources

What are annotations?

- Macros (function calls) that can be easily disabled*
- Inform analysis tool about intended parallelization

Example Intel Advisor annotations:

```
#define ANNOTATE_SITE_BEGIN(NAME)      call annotate_site_begin(NAME)
#define ANNOTATE_SITE_END(NAME)        call annotate_site_end()
#define ANNOTATE_ITERATION_TASK(NAME)  call annotate_iteration_task(NAME)
#define ANNOTATE_TASK_BEGIN(NAME)      call annotate_task_begin(NAME)
#define ANNOTATE_TASK_END(NAME)        call annotate_task_end()
#define ANNOTATE_LOCK_ACQUIRE(ADDRESS) call
annotate_lock_acquire(ADDRESS)
#define ANNOTATE_LOCK_RELEASE(ADDRESS) call
annotate_lock_release(ADDRESS)
```

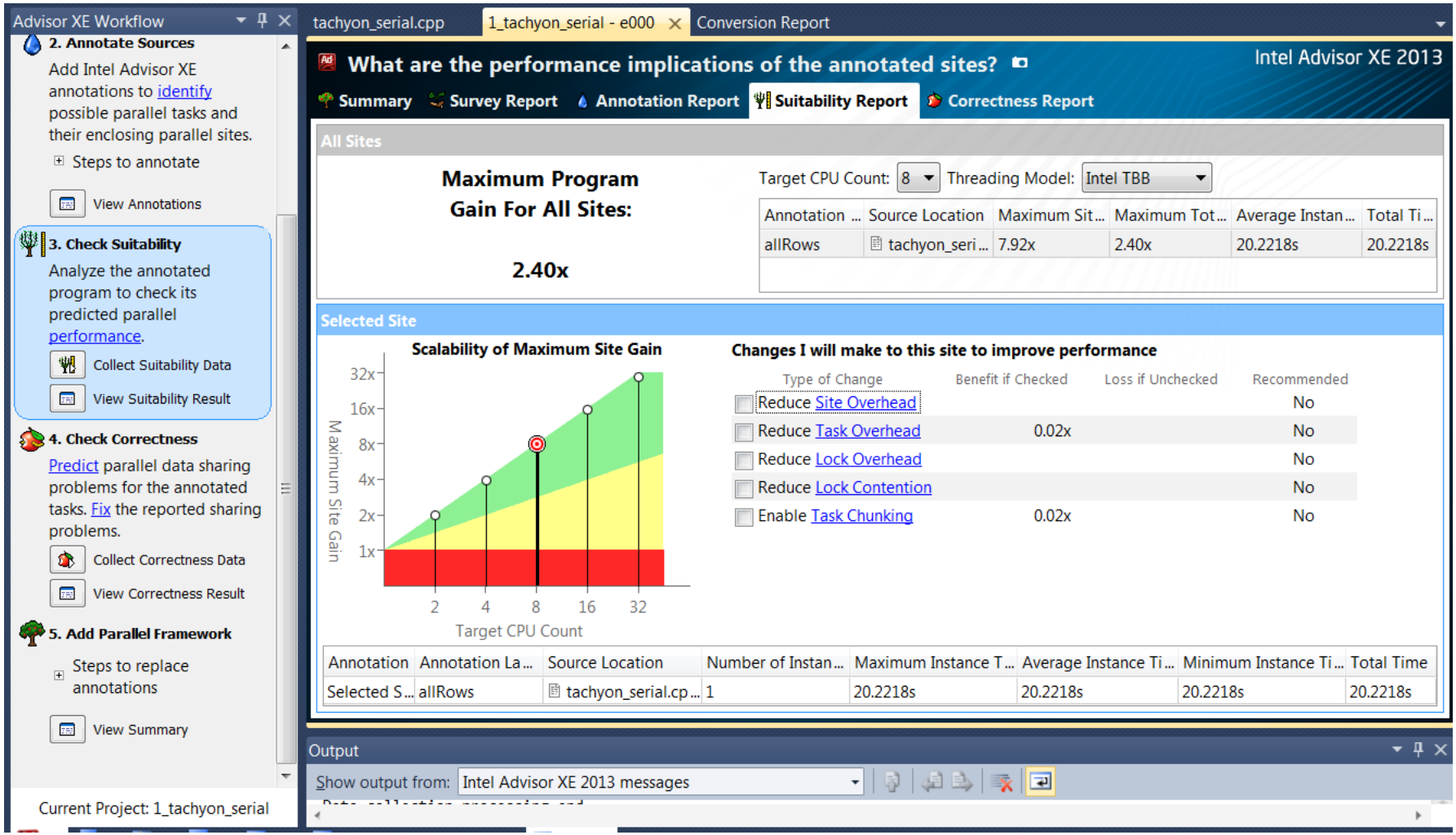
Annotate Sources using Survey Data

Function Call Sites and Loops	Total Time %	Total Time
rt_renderscene	96.2%	19.9664s
renderscene	96.2%	19.9662s
trace_region	96.2%	19.9662s
trace_shm	96.2%	19.9662s
thread_trace	96.2%	19.9662s
parallel_thread [loop]	96.2%	19.9662s
parallel_thread [loop]	96.1%	19.9462s
parallel_thread	96.0%	19.9262s
render_one_pixel	93.1%	19.3208s
trace	79.2%	16.4369s
shader	43.6%	9.0521s
shader [loop]	35.4%	7.3348s

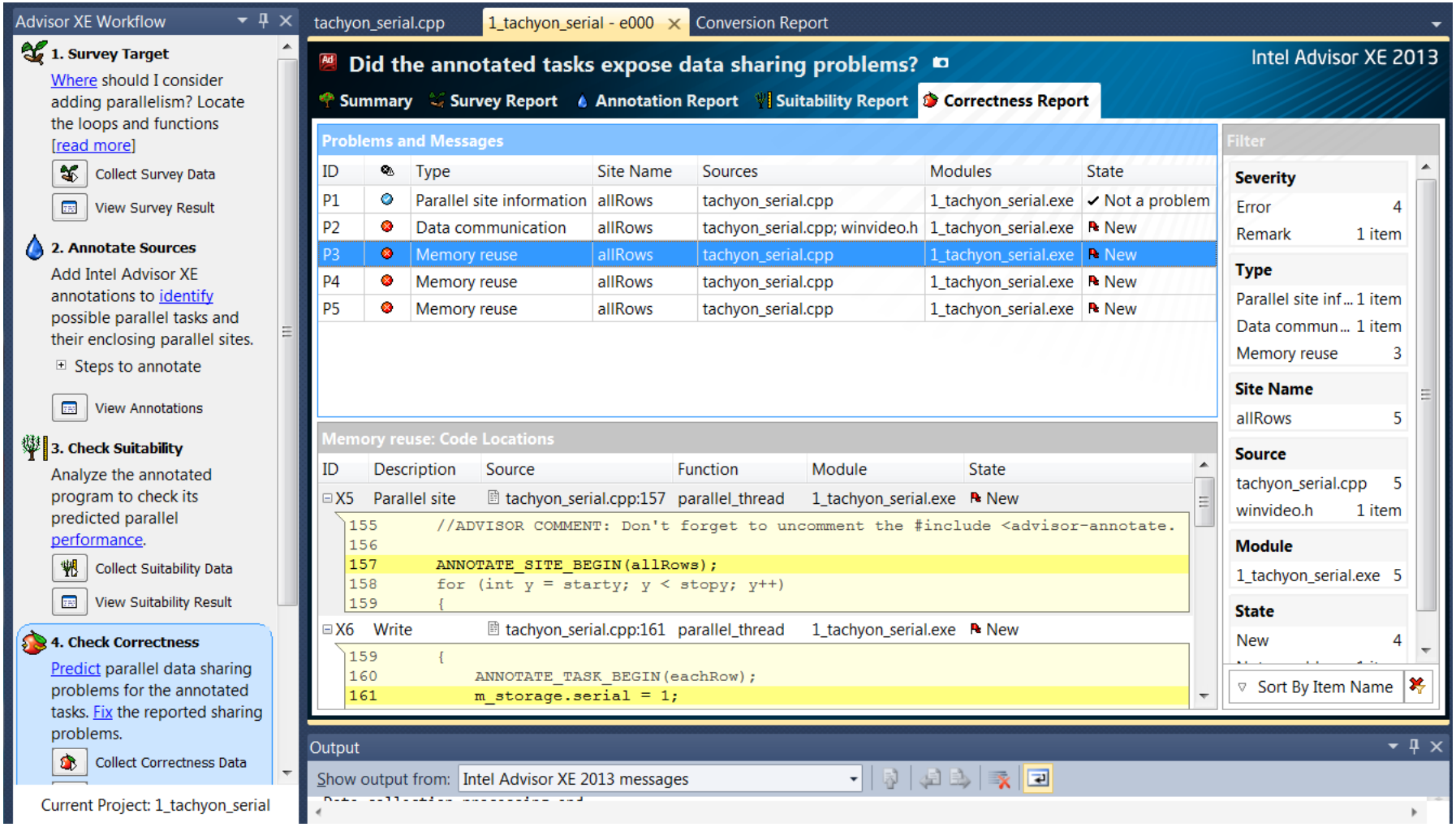
```
ANNOTATE_SITE_BEGIN(allRows);
for (int y = starty; y < stopy; y++)
{
    ANNOTATE_TASK_BEGIN(eachRow);
    m_storage.serial = 1;
    m_storage.mboxsize = sizeof(unsi
    m_storage.local_mbox = (unsigned
    memset(m_storage.local_mbox,0,m_

    drawing_area drawing(startx, tot
    for (int x = startx; x < stopx;
        color_t c = render_one_pixel
        drawing.put_pixel(c);
    }

    if(!video->next_frame())
    {
        free(m_storage.local_mbox);
        return;
    }
    free(m_storage.local_mbox);
    ANNOTATE_TASK_END(eachRow);
}
ANNOTATE_SITE_END(allRows);
```

Pick out expensive loop and add annotations

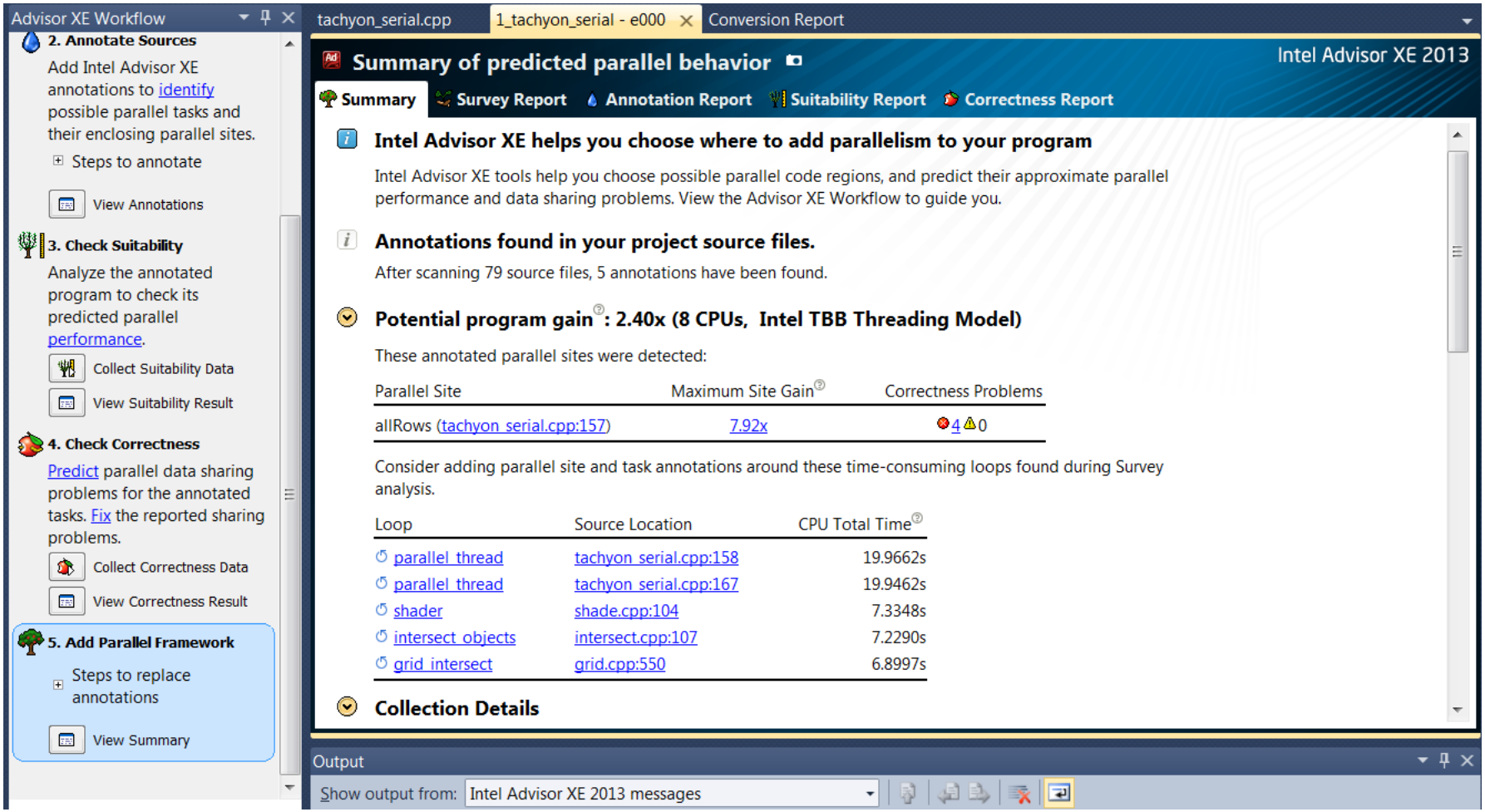
Check Suitability



Check Correctness



Add Parallel Framework



Add Parallel Framework

How can Intel Advisor help?

- Contains overhead metrics for selected models
- Allows to play with some implementation options
- Detailed help pages for different frameworks.

Serial Code with Intel Advisor Annotations	Parallel Code using Intel TBB

`// Locking`
`ANNOTATE_LOCK_ACQUIRE();`
`  Body();`
`ANNOTATE_LOCK_RELEASE():`
	`// Locking can use various mutex types provided`
	`// by Intel TBB. For example:`
	`#include <tbb/tbb.h>`
	`...`
	`tbb::mutex g_Mutex;`
	`...`
	`{`
	`  tbb::mutex::scoped_lock lock(g_Mutex);`
	`  Body();`
	`}`

`// Do-All Counted loops, one task`
`ANNOTATE_SITE_BEGIN(site);`
`  For (I = 0; I < N; ++) {`
`  ANNOTATE_ITERATION_TASK(task);`
`  {statement;}`
`  }`
`ANNOTATE_SITE_END();`
	`// Do-All Counted loops, using lambda expressions`
	`#include <tbb/tbb.h>`
	`...`
	`tbb::parallel_for(0,N,[&](int I) {`
	`  statement;`
	`});`

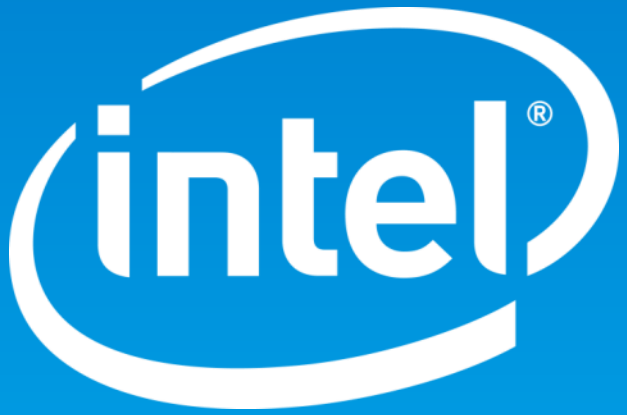
In Summary

Advisor XE is a tool to assist in the parallelization of serial code.

It helps the developer/architect by

- Finding the sections of code taking up most of the time
- Modeling the available speedup for parallelizing those sections of code.
- Finding correctness errors that will occur if the section is naively parallelized

It does all this using a lightweight annotation system to allow quickly trying multiple code change possibilities without choosing a parallel framework.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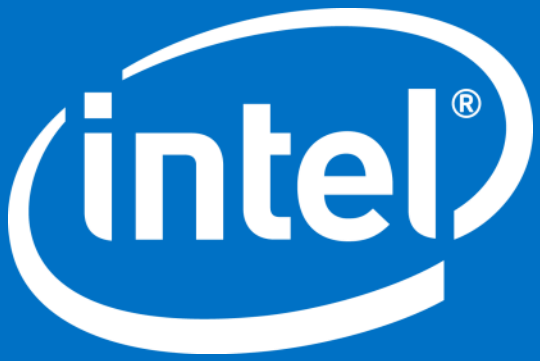
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